Transmit Beamforming and Power Control for Optimizing the Outage Probability Fairness in MISO Networks

Abstract:

This paper studies the joint beamforming and power control in a multiuser multi-input single-output network by utilizing the only statistical channel distribution information. Such information consists of slowly varying covariance matrices in the beamforming network that can be employed to reduce instantaneous feedback overhead in transmission. Utilizing solely the statistical channel information, we study how to minimize the maximum outage probability under a weighted sum power constraint that guarantees max-min fairness to all users. This problem is, however, generally hard to solve due to the nonconvexity and nonlinear coupling between beamformer and power variables. First, assuming a fixed beamformer set, we use the nonlinear Perron-Frobenius theory to design a decentralized algorithm with provable geometrically fast convergence rate to compute the optimal power. Then, for the general case, we examine a certainty-equivalent margin counterpart with outage-mapped thresholds that incorporate the statistical channel information. We show that a network duality for this certainty-equivalent problem can be useful to decouple the coupling between the beamformer and power variables. This nonlinear Perron-Frobenius theory motivated approach yields a feasible beamformer and power allocation that are near-optimal as compared to Monte Carlo averaging simulations.